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CHIPPEWA FIELD STATION

CASS LAKE ~ MINNESOTA

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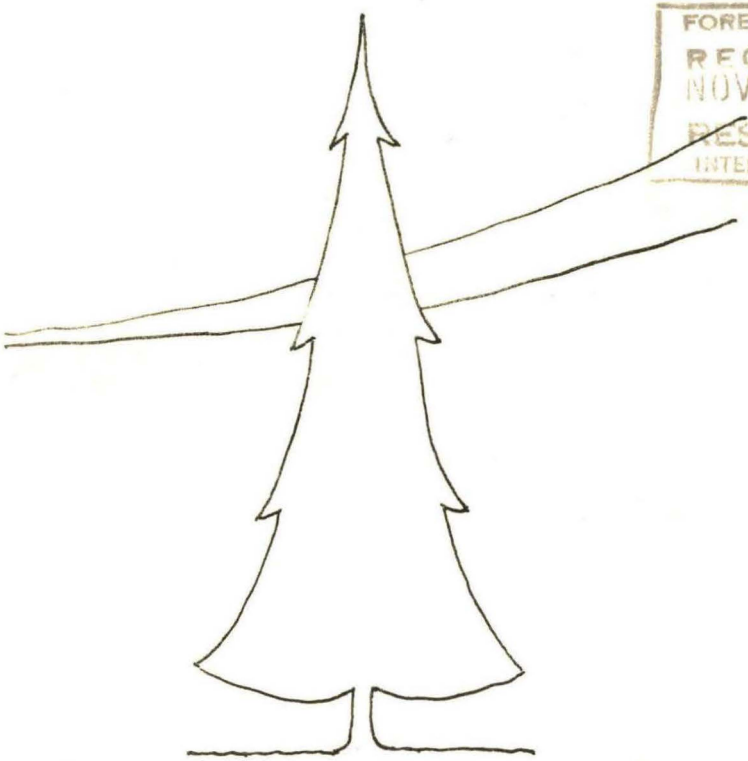

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CHIPPEWA NATIONAL FOREST

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CHIPPEWA FIELD STATION

Cass Lake, Minnesota

Maintained by

Lake States Forest Experiment Station
University Farm, St. Paul, Minnesota
in cooperation with
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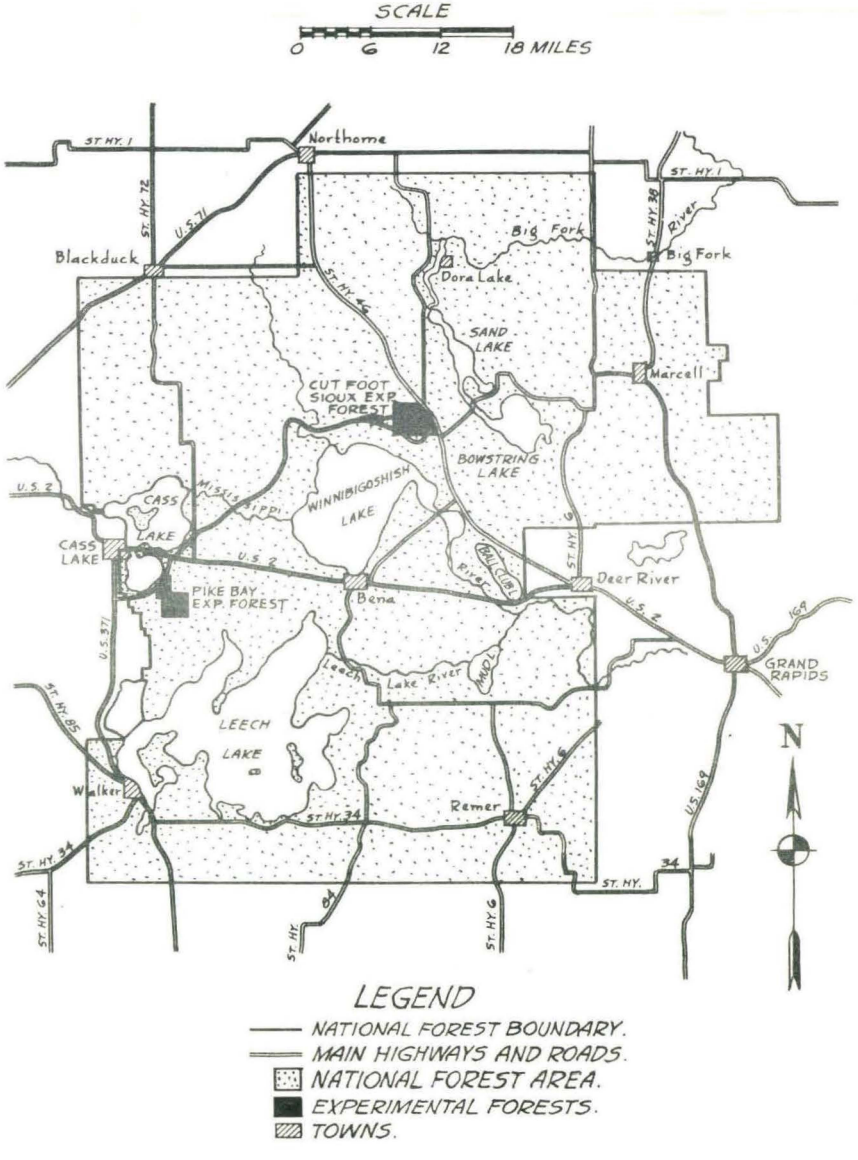
United States Department of Agriculture

FIGURE 1

CHIPPEWA NATIONAL FOREST



LEGEND

- NATIONAL FOREST BOUNDARY.
- MAIN HIGHWAYS AND ROADS.
- NATIONAL FOREST AREA.
- EXPERIMENTAL FORESTS.
- TOWNS.

CHIPPEWA FIELD STATION

LOCATION AND FACILITIES

The Chippewa National Forest, located in north-central Minnesota on the upper reaches of the Mississippi River, has become an important center for research in forestry. Here two experimental forests and a field laboratory are maintained by the Lake States Forest Experiment Station, for study of problems underlying forest conservation in northern Minnesota. The accompanying map (fig. 1) shows how the experimental areas are located with reference to highways and to Cass Lake, headquarters of the Chippewa Forest. Cass Lake lies about 220 miles northwest of the Twin Cities.

Pike Bay Experimental Forest

The Pike Bay Experimental Forest, 5 miles southeast of Cass Lake, is an area of 3,940 acres timbered chiefly with aspen and mixed hardwoods. A belt of aspen reaches through it from north to south, merging on the west with pine and on the east with hardwoods and balsam fir. The entire area was cut over for pine between 1902 and 1915; no pine was left except scattered seed trees and immature stands. A great part of it was logged also for aspen and hardwoods, between 1925 and 1929. Consequently the stands now present are immature second growth and decadent cut-over hardwoods. In all their major aspects, this forest fairly represents the aspen and mixed hardwood forests of northern Minnesota.

Cutfoot-Sioux Experimental Forest

The Cutfoot-Sioux Experimental Forest, on State Highway No. 46 about 15 miles northwest of Deer River, has an extent of

about 3,050 acres. This area, also, was cut over for pine, during the period 1902-20. At that time extensive stands of mixed red and jack pine were still too small to be merchantable; now 70 years of age, these are some of the most valuable young pine stands on the Chippewa Forest, typical of those on the better pine lands of northern Minnesota. The management problems presented by this forest resemble those encountered on the jack and red pine timberlands in Minnesota held by pulp and lumber companies and by small landowners.

Cass Lake Field Laboratory

The field laboratory is located in the basement of the Chippewa Forest headquarters building, in the town of Cass Lake. It is equipped with apparatus adequate for simple chemical and physical analyses of soils and plant material. At present it is being used chiefly for studies of drought resistance of pine seedlings.

HOW RESEARCH HAS DEVELOPED ON THE CHIPPEWA

It was natural that the Chippewa National Forest should become a center for the development of scientific forestry; it was the first national forest in the United States to be logged under Forest Service supervision, and field studies to determine the silvicultural effectiveness of the cutting methods used were begun on it in 1912. With the establishment of the Lake States Forest Experiment Station, in 1923, these studies were enlarged, and by 1929 a total of 39 permanent sample plots had been established. In that year the experiment station definitely chose the Chippewa Forest as one of its principal research centers, and assigned a staff member permanently to the work there.

A small laboratory was constructed in 1931 on the grounds of the Cass Lake forest nursery. This served until the new

headquarters building, including research offices and laboratories, was completed in 1936. The two experimental forests were formally set aside for research in 1932, and were enlarged in 1936. An experimental nursery was established on the Pike Bay Forest in 1934.

To the original 39 permanent sample plots, more than 90 have been added. (The latter and 7 of the former lie within the experimental forests.) Most of these plots contain about an acre each. Practically every plot has a sign to tell visitors what has been done on it. Use is made also of temporary sample plots established from time to time on the experimental forests or elsewhere on the Chippewa Forest.

Through the cooperation of forest administrative officers, special problems are studied by means of large-scale operations if such methods appear most likely to yield results. The entire Chippewa Forest is a proving ground for the results of intensive studies. Administrative officers cooperate also by calling attention to new problems, and assist in constructing new equipment needed for experimental work.

Because of the forest-products requirements of the iron-mining districts in northern Minnesota, and of sawmills and box factories in towns adjacent to the Chippewa Forest, the field station has excellent opportunities for marketing its products--a requisite of intensive silviculture.

MAJOR PROJECTS

The major forest problems of north-central Minnesota are those associated with management of aspen, pine, swamp forests, and brush lands. Work at the Chippewa Field Station is concentrated on the following projects: (1) Obtaining better yields from thrifty aspen; (2) converting decadent aspen to conifers;

(3) improving pine-aspen mixtures; (4) producing hardy planting stock; (5) converting brush lands to forests; (6) increasing growth of young pine by thinnings; (7) increasing yields of pine stands through selective cutting; (8) assuring regeneration of pine forests; (9) testing new tree species and strains for Minnesota; (10) improving swamp forests; (11) introducing better logging and utilization practices.

Better Yields from Thrifty Aspen

Aspen, formerly considered to be merely a forest weed, now commands a good price if suitable for veneer, match stock, food containers, or other specialty products. To be used for these products, aspen logs must be relatively large, and free of knots or discoloration. Logs of this description can be grown only on good aspen sites such as are found on the Pike Bay Experimental Forest. Even on such sites the stands deteriorate rapidly after reaching the age of 50 years, so that the yield of high-quality logs at harvest is extremely meager. The major problem of aspen management, therefore, is to determine how trees can be grown to sufficient size to be valuable for veneer or food-container stock before rot sets in. Two methods are now being tested.

The first method, thinning young aspen stands, is best exemplified by sample plots near the junction of U. S. Highway No. 2 and the Blackduck road. A stand thinned in 1929, when it was 20 years of age, now contains trees up to 9 inches in diameter, a size normally reached in unthinned stands only at the end of 45 years. A 13-year-old stand on the Pike Bay Experimental Forest was thinned in 1936.

The other method, selective cutting (fig. 2), is being tested on several areas. The cuttings that have been made were designed to increase the total yield and also to increase the yield of high-quality material. Results have shown that the cut

Figure 2.--Selection cutting in aspen on Pike Bay Experimental Forest. Trees remaining were chosen because of their promise for future growth.

of merchantable saw timber is not much less if all trees less than 9 inches in diameter are left uncut than if the diameter limit is 8 inches. Stands 47 years old in which this has been done give promise of producing within 15 to 20 years a second cut approximately equal to the first in volume, and better in quality. Cutting of all trees 8 inches or more in diameter, on the other hand, leaves the stand in poor condition for future growth.

At 65-70 years of age the remaining trees should be cut. As aspen reproduces abundantly by sprouting from the roots, clear-cutting at maturity is followed by adequate natural reproduction.

Converting Decadent Aspen to Conifers

Aspen growing on sandy soils is of very poor quality and rarely attains merchantable size. One of the major forest problems of the Lake States, therefore, is to determine how valuable conifers can be restored to the sandy areas now occupied by aspen, birch, and associated species.

This problem, first attacked in 1926, was studied intensively from 1929 to 1936. The results are most clearly evident on sample plots 37, 38, and 39, located on the Pike Bay Forest near the experimental nursery. Large-scale experiments are in progress in numbers 1, 30, and 33 of the 40-acre blocks into which the forest is divided. The shrubby under-vegetation, these experiments indicate, is usually the most serious competitor of young conifers that might become established naturally under aspen. To effect conversion it is necessary to plant large, healthy stock, to remove competing under-vegetation, and to thin the overstory. Release cuttings are needed for from 2 to 5 years after planting. Recent experiments in which heavy road-building equipment was used to clear the undergrowth have indicated that the cost of conversion can probably be reduced to $25 or less

per acre.

Improving Pine-Aspen Mixtures

Pines that become established immediately after fires often persist, even though badly suppressed by aspen seedlings of the same age. In such a case the stand can be greatly improved by taking out a portion of the aspen. White pine seedlings, in particular, quickly increase their growth rate after being released from competition. Examples of this type of work may be seen at several points along the road through the Pike Bay Forest.

Producing Hardy Planting Stock

Losses in forest plantations in Minnesota during the years since 1929 have emphasized the need for developing planting stock more resistant to drought. To test drought resistance a special machine (fig. 3) has been devised, in which seedlings are subjected to a standard degree of drought. Results of tests in this machine have shown a close correlation with field survival during drought periods. Seedlings have been tested in the machine at Cass Lake during the summer months since 1932. The tests have shown that drought resistance can be induced in coniferous seedlings by subjecting them to moderate soil drought in the seedbeds, and that resistance induced in this manner persists in part throughout the second season. Nursery soil fertility, origin of seed, and shading are other factors that have been found to influence drought resistance. Waxy coatings applied to the needles of seedlings have not proved effective as a means of improving resistance to drought.

The possibility of producing high-quality planting stock in a small forest nursery such as might be operated by forest guards or by farmers, with a little advice and supervision from a skilled nurseryman, has been demonstrated in the experimental nursery (fig. 4) on the Pike Bay Forest. The major requirements

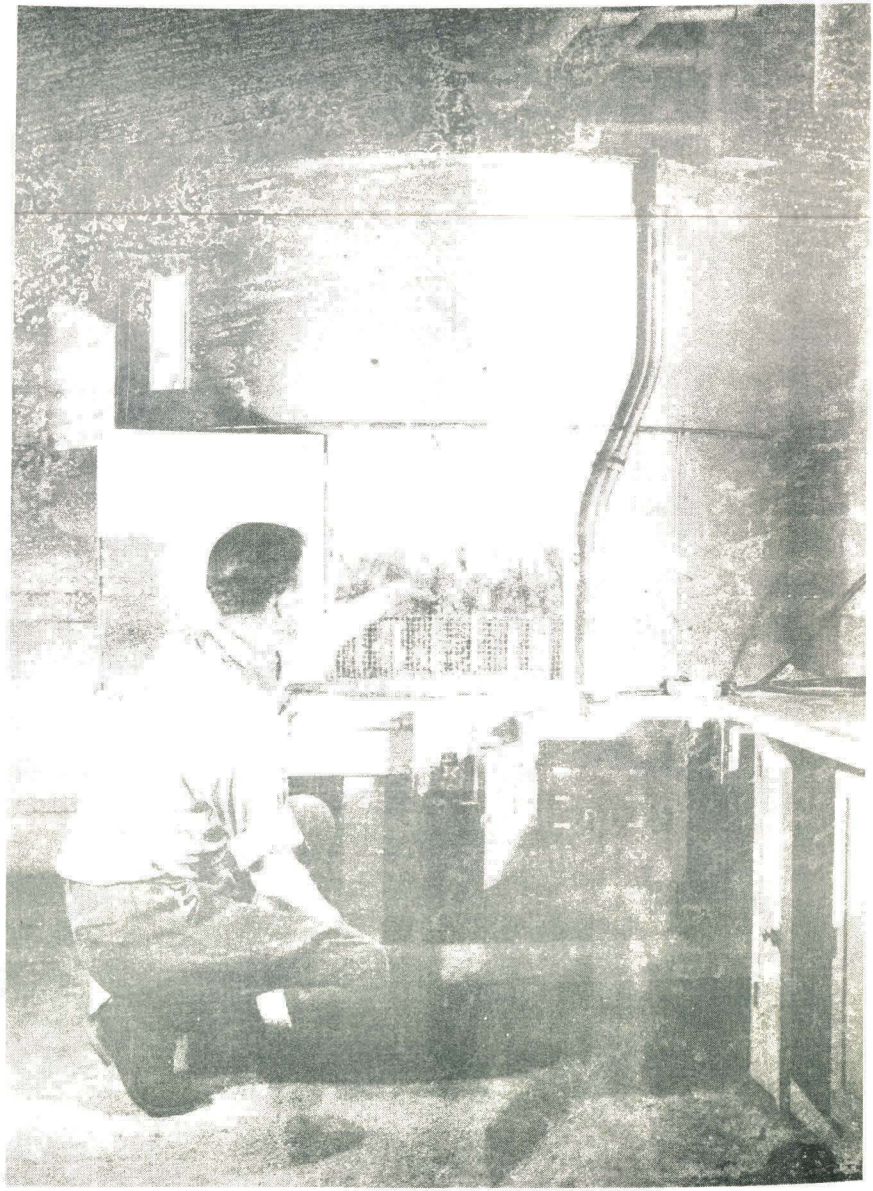


Figure 3.--Drought machine at Cass Lake laboratory ready for test of young pines.

for such a nursery, experience indicates, are that it be located on fertile, well-drained sandy loam soil; that it be protected on all sides from high winds; and that an emergency watering system be available for use during germination, during the transplanting and lifting period, and during periods of excessive drought. Probably the cost per 1,000 seedlings could not be held so low as in a large nursery, but certain advantages might in part offset higher cost.

At the present time the experimental nursery is being devoted chiefly to growing trees of various exotic species.

Converting Brush Lands to Forests

Closely related to the problem of converting aspen and inferior hardwoods to conifers is that of converting brush lands to forests of valuable species. Planting experiments along the western border of the Pike Bay Experimental Forest indicate that the same general type of treatment is adequate for conversion of brush as for conversion of aspen. Brush types, being less aggressive than aspen or hardwoods, are more easily converted.

Increasing Growth of Young Pine by Thinnings

Long before the advent of the CCC, the Lake States Forest Experiment Station began tests to determine how thinning would affect 20- to 25-year-old stands of red pine and of Jack pine, and under what circumstances thinning of such stands would be justified financially. Thinned stands (fig. 5) have grown much faster than unthinned stands. The indications are that early thinning will bring pine stands to merchantability 10 to 15 years ahead of unthinned stands. Final verification of this point, and appraisal of the ultimate financial and silvicultural benefits, must await further development of the thinned stands.

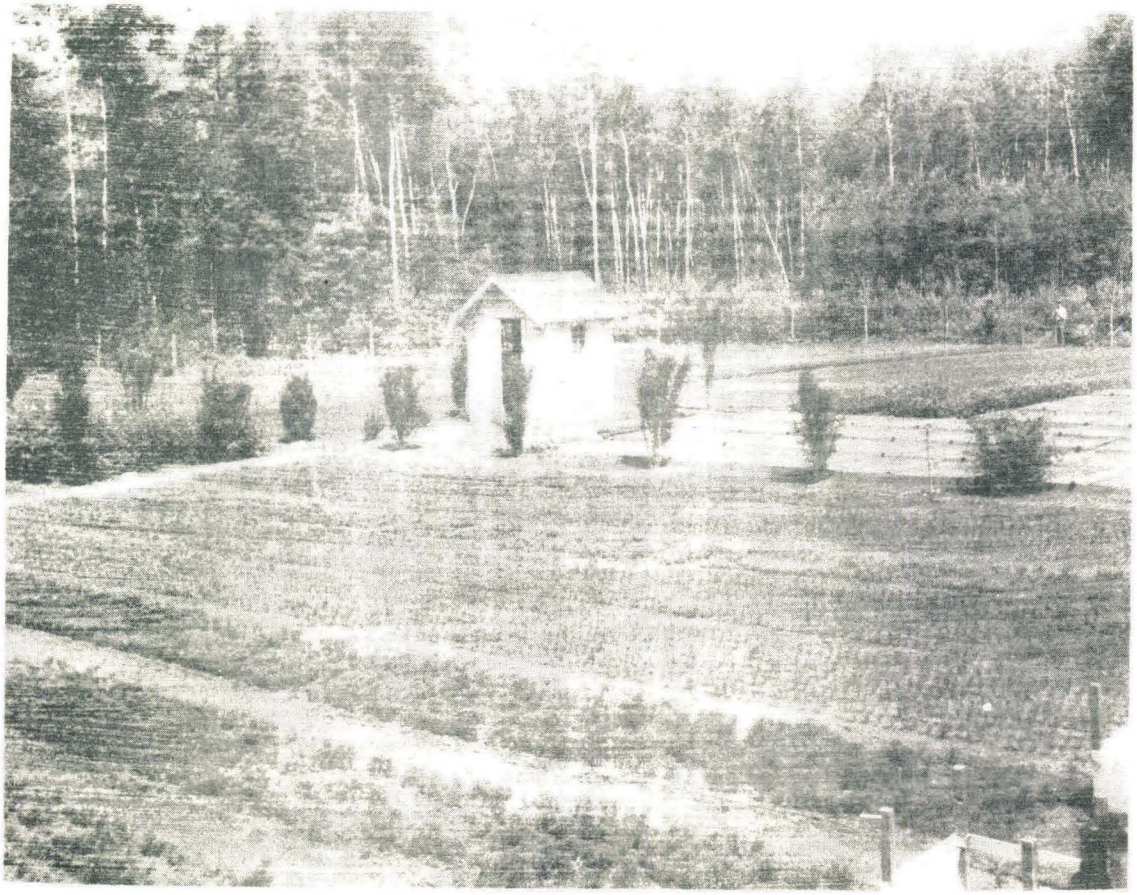


Figure 4.--View of experimental nursery on Pike Bay Experimental Forest. In foreground second-year seedlings and transplants; in middle ground, newly sown beds; in center, pump house.

Figure 5.--Light selection cutting in mixed pine on Cutfoot-Sioux Experimental Forest. A total of 2,285 board feet per acre was removed, mostly in large-sized jack pines.

Increasing Yields of Pine Stands through Selective Cutting

Jack pine, like aspen, requires very careful management if maximum yield is to be realized. In early life the stands often have a tendency to stagnate, owing to overcrowding. Natural mortality, due to wind breakage, fungus attack, and porcupine injury, frequently thins out older stands to such an extent that their yields are appreciably reduced.

Experiments now under way have proved that the old system of managing jack pine, which called for harvesting approximately 70 percent of the volume in the first cut and burning all logging slash, does not result in satisfactory regeneration. Even if not followed by wind throw, such a cutting has the further disadvantage of reducing density to such a degree that the growth per acre of the residual stand is only one-fourth to one-third that of uncut stands. Selective cuts of 15 to 20 percent of the merchantable saw timber do not greatly reduce the growth rate of the stand as a whole and do not open up the stand to such an extent that underbrush can become established. Examples of improved management of jack pine can be seen on several cutting areas on the Cutfoot-Sioux Experimental Forest.

Mixed stands of red and jack pine are somewhat easier to handle. Jack pine usually grows more rapidly in early life and attains merchantable size much quicker than red pine. It may be removed in a series of light cuttings beginning when the stand has reached the age of 45 years. By the time the stand is 90 years old the last jack pine should be cut. Cutting of large, limby, or otherwise less desirable red pine may be carried on concurrently, the more desirable red pines being reserved until valuable for piling or saw timber. Some of the red pine may be carried until 120 years old or older.

If cuttings are made judiciously the indications are that well-stocked mixed stands of red and jack pine can be kept growing at a rate of 300 to 400 board feet per acre per year from the 50th to the 120th year. Growing at such a rate, they would yield almost twice the volume that would be realized if they were removed by clear-cutting.

Examples of many different cutting practices in mixed pine stands can be seen on the Cutfoot-Sioux Experimental Forest.

Assuring Regeneration of Pine Forests

The large aggregate area now occupied by aspen and brush in Minnesota is the result of failure of pines and other tree species to reproduce after logging and fire. Scrub types are destined to encroach even farther on the pine types unless certain precautions are taken at the time of logging. If pine forests are to renew themselves after logging there must be an abundant supply of pine seed and the seed must reach a receptive seedbed. Abundant seed of jack pine can be had from unopened cones in the logging slash. Where reproduction is desired the ground should be scarified in advance of logging, with a disk or spring-tooth harrow, and although the heavy slash resulting from logging may be burned progressively the light slash containing the cones should be lopped and scattered. Red pine produces seed at irregular intervals only; to assure reproduction of this species it is necessary that scarification and logging be carried out in years of good seed crops. Where white pine or red pine seedlings become established as advance reproduction in old stands, they may become the nucleus of a new stand if their growth is favored by group selection cutting.

All three methods of obtaining regeneration of pine stands are illustrated by experimental plots on the Chippewa National Forest.

Testing New Tree Species and Strains for Minnesota

In 1927 the Lake States Forest Experiment Station began a Nation-wide search for geographic strains of red pine which it might test in various localities throughout the Lake States. Preliminary tests were begun in 1931. Plantings made in the spring of 1937 occupy one of the fenced enclosures on the Pike Bay Experimental Forest. Regional differences as exemplified by growth rate were evident by the end of the first year in the field. A test of Scotch pine stock derived from several localities in Europe and in the United States and a small-scale test of Norway spruce from various sources were established in 1937.

In the spring of 1938, as a part of an international study of seed provenience, the station sowed Scotch pine seed from 15 localities, and Norway spruce seed from 20 localities in the Baltic region.

In cooperation with the Northeastern Forest Experiment Station, New Haven, Conn., the station is testing various first-generation aspen hybrids. The hybrids have been planted on a special plot near the experimental nursery. Those tested to date have proved insufficiently hardy for the locality, few of them coming through the first winter without being killed back to snow line. Efforts are being continued to find aspen hybrids combining the desirable characteristics of rapid growth and winter hardiness.

A number of other species from Europe, Asia, and South America are being tested for hardiness in Minnesota, on an arboretum plot within the Pike Bay Forest.

Improving Swamp Forests

Two drained swamps are under observation on the Chippewa Forest. One of these supports an immature stand of black spruce

and tamarack. Following drainage the trees have grown at a remarkable rate. Inasmuch as the observation period has been one of unusual drought, it is not certain how much of the added growth has resulted from drainage and how much from reduction of rainfall. Unmistakably, however, trees located near the drainage ditches are growing more rapidly than trees far from the ditches. The second swamp, originally a meadow, was planted to pine and spruce following drainage; it is still too early to predict the results.

Introducing Better Logging and Utilization Practices

So far as possible, logging on the experimental forests is delegated to private operators. When a new experimental method is to be tried out, the area is selected, the timber marked, and the policy to be followed explained on the ground to prospective buyers. The purchaser is required to carry out faithfully the method decided upon. Practical difficulties introduced by new methods are worked out jointly by the experiment station and the operator. In this way the work of the station is tested under practical operating conditions, and a realistic program of research is assured. At the same time, timber operators become acquainted with silvicultural objectives.

WHAT THIS PROGRAM MEANS TO FOREST CONSERVATION

The Lake States Forest Experiment Station is interested not only in seeing the results of research put into practice on the national forests but in making these results available to all forest owners in Minnesota. Information made available through the station's work, if generally applied throughout the State, would make it possible to prevent further depletion of forest land and would assure a larger and more uniform yield of forest

products for the future. Wood-lot owners, timber operators, lumber companies, and others interested in the management of timberlands are invited to become acquainted with the work on the ground, and to consult the local staff about their timber-management problems.

OTHER FOREST RESEARCH CENTERS IN MINNESOTA

In addition to the Chippewa Field Station, the Lake States Forest Experiment Station maintains in Minnesota the Superior Field Station, located 13 miles southeast of Ely, where forest problems of the spruce swamps and rocky soils of northeastern Minnesota are studied. For study of problems encountered in the district surrounding Duluth and Cloquet, the University of Minnesota maintains an experimental forest at Cloquet.